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Behaviorally Structured Consumer-Resource Dynamics

Animals adjust their behavior in response to physiological states to optimize the trade-off between energy acquisition and survival. Consistent individual differences in behavior, often referred to as animal personality, play a crucial role in shaping ecological and evolutionary dynamics, particularly in foraging behavior. Traditional approaches in behavioral and evolutionary ecology typically focus on average behavior, neglecting the significance of individual variability. This study examines the impact of consumer behavior on ecological dynamics, focusing on how variations in food availability influence behavioral strategies and ecosystem functioning. The diverse expression of behavioural changes in a population has the potential to influence the whole population. This phenomenon has been modeled using a variety of methods, including population compartment models. Rather than make use of discrete levels of expression, we propose a novel model that treats the behavioural phenotype as a continuous distribution. The result is a coupled system composed of an ordinary differential equation and a partial differential equation, with the dynamics associated with behavioural phenotypes modeled as a diffusion process. The resulting analysis avoids some of the difficulties of scaling to larger systems of equations and opens up the possibility of using other techniques available for the qualitative analysis of partial differential equations.